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July 6 1995

Katie Hafner
101 W 6th St., Suite 802
Austin, TX 78701

Dear Katie,

As promised, I am sending you documents relating to the contract between CCA and Lincoln Lab. It feels a little bit like I just opened a time capsule.

1. May 7, 1965 letter proposal from me to Fred Frick at Lincoln Lab, proposing network project.
2. May 13 answer from Fred. Pretty non-committal
3. June 23. Follow-up proposal letter to Larry Roberts. Proposes a network of six computers. Looks like people came pretty cheap in those days.
4. June 25 proposal abstract. Talks about a Nationwide Cooperative Computer Network.
5. June 28. List of CCA research proposals. Network proposal is the second one on the list.
6. July 2. Letter from Jack Raffel at Lincoln accepting ²our proposal.
7. November 26. Letter proposal to Larry Roberts for continuation past December 1965.
8. Reprint of paper given at Fall Joint Computer Conference, 1966.

Let me know if you have any questions.

Best regards,



Thomas Marill

7 May 1965

P65-RD2

Dr. Frederick C. Frick
MIT Lincoln Laboratory
Lexington, Massachusetts

Dear Fred:

I understand from our recent conversation that your Division of Lincoln Laboratory may be interested in exploring the potentialities of computer networks. We at CCA have given considerable thought to the networking concept; we look on networking as one of the next major developments in computer technology, and we are eager to assist in the exploration of this development.

I would like to propose that CCA undertake a program, under contract to Lincoln Laboratory, to assist Lincoln in exploring and developing the potentialities of computer networks. Specifically, I have in mind tying our computer to Lincoln's TX-2 in order to provide a testbed for this program. For technical reasons, the TX-2, together with the time-sharing system you currently have under development, seem to us to provide an excellent focus for such an experimental network.

The overall direction for the research program will, of course, have to come from Lincoln. However, let me make certain suggestions as a base for discussion. I see three separable phases: (a) initial implementation, (b) shake-down, (c) evaluation.

In the first phase, it will be necessary to specify and implement suitable hardware and software to allow inter-computer communication to take place. If a number of good alternatives present themselves, I think we should implement several and carry these in parallel throughout the study to the evaluation phase.

Dr. Frederick C. Frick
7 May 1965
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During the second phase we would run a representative set of problems in the network (examples: display maintenance, compilation, searching and updating of files kept in another portion of the network, simultaneous problem-solving by several computers in the net, text editing). As these shake-down problems are run, modifications of the original system will suggest themselves, particularly as regards the procedures that determine which part of a problem is to be sent from one portion of the net to another. In short, the second phase will consist of a cyclic process involving experimentation, modification of system parameters and procedures, back to experimentation, etc.

The final phase is evaluation. There are two realms in which the system might be evaluated, scientific and commercial. I take it that Lincoln is interested only in scientific (research) applications; hence commercial applications will be ignored.

One of the ways of evaluating the networking concept is to design a formal evaluation program to determine the advantages and disadvantages of networking (or of alternative networking techniques, if alternatives have been carried along) for a range of prespecified problems. The advantages stem from the possibilities for load-sharing, parallel processing, matching of processors to the characteristics of the problem, increased reliability, communication among research centers, existence of a channel for cooperative planning, and others. The disadvantages stem from increased hardware and software complexity and cost, possible interference of one computer with another, need for cooperation and standardization, security problems, and probably others.

A second way of evaluating networking in its research application is to use the network as a vehicle for performing actual research. If this approach is selected, CCA would take a portion of one (or perhaps several) of its research projects and pursue the research using the network facility. In view of this, it is pertinent to state briefly some of the research areas CCA intends to pursue. They are: (1) Question-Answering Systems (natural-language interactive systems), (2) Intelligent Automata (devices that see, locomote, and manipulate objects to accomplish assigned missions), (3) pattern recognition, (4) graphic aids to programming (such as Roberts' on-line flow-charting, Licklider's "introspection"), (5) graphic aids to data-analysis (visual techniques for non-parametric factor analysis).

Dr. Frederick C. Frick
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P65-RD2

We have not yet costed out this project in detail. A preliminary estimate is in the neighborhood of \$150,000 for an eighteen-month period.

At your convenience, I would like to discuss this matter in greater detail with you, and to answer any questions you might have about the proposed project or about CCA.

Best regards,

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Thomas Marill

TM:shm

cc: Lawrence G. Roberts

(2)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY
LEXINGTON, MASSACHUSETTS 02173

13 May 1965

Area Code 617
862-5500

Dr. Thomas Marill
Computer Corporation of America
111 Broadway
Cambridge, Massachusetts 02142

Dear Tom:

Thank you for your recent letter and informal proposal on research into computer networks.

This is an area that I personally believe important to computer technology. This opinion is shared by most of my colleagues though we have not yet clarified our notions to the extent of seriously considering contract support.

We will certainly keep your interest in mind in future discussions of our program.

Sincerely,



Frederick C. Frick
Head, Data Systems Division

FCF:py

(2)

23 June 1965

Dr. Lawrence G. Roberts
MIT Lincoln Laboratory
Lexington, Massachusetts 02173

P65-RD7

Dear Larry:

You recall that at the beginning of May we made an informal proposal to Dr. Frick for research in the area of computer networks. His response was that he and most of his colleagues believed this area to be one of importance for computer technology, but they had not yet clarified their notions to the extent of seriously considering contract support.

Our own interest in this matter remains very high. We see growing up about us a number of large, vital projects built around time-sharing facilities, but almost no attempt to pull together these disparate activities. You may recall the ARPA meeting at Carnegie Technology on 26 February, which we both attended. Most of the important work in time-sharing was represented in that room, yet I do not remember any effort to coordinate the projects, to achieve a common ground for exchange of programs, personnel, experience, or ideas. My impression was of a number of essentially similar projects each going off in its own direction with complete disregard of the others.

It seems to me that one way to remedy this unfortunate state of affairs and to achieve some coordination is by making each installation accessible to all the others. In doing so a channel of communication is opened, and it becomes worthwhile for the people involved to consider their relation to the other systems, since by doing so their own facility can gain enormously in power. In short, I see the concept of the computer networks as being able to fulfill such a coordinating function.

Dr. Lawrence G. Roberts
23 June 1965
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Who might fulfill this coordinating role and undertake the creation of such a network? I think Lincoln Laboratory is in a good position to do so. It is not the only organization who might do it, but it is one of the few.

One might ask further how this whole matter might proceed. In view of the present uncertainty in the Lincoln plans, it seems to me that a reasonable approach would be to make a feasibility study to help clarify the notions. If the results of the study are encouraging, then Lincoln may choose to move ahead with a networking project. If the results are discouraging, the whole matter can be dropped.

Our company would be pleased to undertake this feasibility study. We would plan to study six systems in all, two at each of three places, namely:

1. Lincoln Laboratory: TX-2, 360.
2. Project MAC: 7094, GE636.
3. SDC: Q-32, 360.

The principal question to be determined is: what is required to place each of these systems into a network? Some of the more specific questions to be answered are: what would it cost (hardware and software); how long would it take; what manpower is required; what administrative arrangements need to be made and with whom; what is the likelihood that these arrangements can be satisfactorily made; what programming is required, and who might provide it; if the implementation of the network is undertaken, in what order should the systems be brought in; how might a test be devised to provide an evaluation; what communication lines should be used; will the telephone company cooperate?

The outcome of our proposed study would be incorporated into a report. Our report would be delivered no later than two and a half months after receipt of purchase order. During this time we would provide five man-months of effort. The total estimated cost is \$17,580.

The financial data are as follows. We propose a time-and-materials contract. Our charges would be made at our regular hourly consulting rates. Out-of-pocket expenses such as printing, travel, and long-distance telephone would be charged at cost. The study would be performed by the following personnel at the indicated rates.

Dr. Lawrence G. Roberts
23 June 1965
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Thomas Marill	\$25/hour
Burton H. Bloom	\$16/hour
William F. Mann	\$12/hour
Wesley A. Clark	\$35/hour
(Associated consultant)	

The total time charges are estimated at \$15,660. The total out-of-pocket charges are estimated at \$1,920, giving a total of \$17,580.

It might be asked why our company rather than some other should be retained for this study. A number of reasons come to mind. (a) My associates and I have been associated with time-sharing projects as long as there have been such projects, and we are familiar with them. (b) Since SDC uses a PDP-1 computer as an interface for its time-sharing system, it is pertinent to point out that we know that computer well; the group I headed at EBN acquired the first delivered PDP-1 and we wrote much of the basic software for it. (c) Wes Clark is, of course, familiar with the TX-2 and is a good man to have on board when it comes to hardware questions. (d) Bloom is familiar with MAC (being in the process of finishing his Ph.D. thesis on that system) and with SDC (having spent one summer and other times out there as a computer consultant). (e) Mann wrote one of the first time-sharing systems ever, and has been involved with time-sharing monitors ever since. (f) A good deal of this study will hinge on personal contacts; we are fortunate in being personally acquainted with most of the workers in this field, and in particular with those in the three institutions forming part of this study.

Sincerely yours,

Thomas Marill

TM:shn

P65-RDS-8
25 June 1965

Proposed Research Project

Summary

Title: Nationwide Cooperative Computer Network

Long-Range Goal: To develop the technology and provide the background of experience necessary for the design and implementation of a nationwide cooperative computer network.

Importance of Problem: The contemplated computer network would allow each cooperating computer installation to have on-line access to the others. It thereby would provide greatly increased computational power at the cooperating installations. Furthermore, it would allow programs available at one cooperating installation to be incorporated into systems running at another, without requiring nation-wide standardization of hardware or programming languages.

Phases of Proposed Project:

A. Feasibility Study. It is proposed first to undertake a feasibility study to provide answers to questions such as the following. What current computer installations could readily become elements of the network? What would it cost to incorporate these into the network? How long would it take? What administrative arrangements would need to be made and with whom? What programming would be required, and who might provide it? What communication lines should be used? What extra hardware is necessary? What would be the immediate and long-range advantages? The disadvantages?

B. Pilot Model. It is proposed secondly to implement a pilot model allowing actual networking to take place between cooperating installations. This phase will provide the necessary experience for the specification of a full-scale network. Particular consideration will be given to second-generation time-sharing systems, whose specifications must provide for ease of incorporation into the network.

Time-scale: Nine months will be required to complete the feasibility study (Phase A). Twelve months will be required to put the pilot model into operation (Phase B).

Funding: The required funding is approximately as follows.

Phase A	\$ 50,000 for nine months
Phase B	\$250,000 for one year.

Personnel: T. Marill, B.H. Bloom, W.F. Mann, W.A. Clark (associated consultant), programmers and technicians as required. Dr. Marill has been associated with the development of on-line time-sharing projects since their inception. Mr. Bloom has been a computer consultant to SDC and a long-time user of Project MAC. Mr. Mann wrote one of the first time-sharing monitors. Professor Clark is a computer designer of outstanding reputation.

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ADAPTED FROM ...

28 June 1965

CURRENT RESEARCH PROPOSALS

- P65-RD8S Reconnaissance Automaton.
 Development of an automaton for performing
 reconnaissance missions.
- ~~P65-RD9S~~ Nationwide Cooperative Computer Network.
 Development of a network allowing on-line
 computer-to-computer communication.
- P65-RD10S Perceptual and Learning Processes for Computers.
 Automatic techniques for learning three-
 dimensional scene-analysis.
- P65-RD11S A Computer Program that Plays Chess at the
 Master Level.
 Development of computer techniques for
 playing chess, with applications to decision-
 making in competitive situations.
- P65-RD12S Semi-Automatic Classification Techniques.
 Use of computer displays to help statisticians
 solve complex classification problems.
- P65-RD13S Representational Structures.
 Non-linguistic representation of arbitrary
 information, with applications to mechanical
 translation and information retrieval.

(6)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY
LEXINGTON, MASSACHUSETTS 02173

Area Code 617
862-5500

2 July 1965

Mr. Thomas Marill
Computer Corporation of America
111 Broadway
Cambridge, Massachusetts 02142

Dear Mr. Marill:

Based on your letter of June 23 to Larry Roberts, we have agreed that a feasibility study of a computer network linking SDC, Lincoln, and MAC is a reasonable undertaking at this time. If you could draw up a proposal containing essentially the material in that letter (starting at about paragraph 3, page 2) and send it to Mr. L. Cores in our Purchasing Department, we can start the preliminary paperwork.

Sincerely yours,


J. I. Raffel
Group Leader
Digital Computers Group

JIR/smc

COMPUTER CORPORATION OF AMERICA

77 FRIDAY • CAMBRIDGE MASS. 02142 • TEL. 617/491-3670

26 November 1965

P65-RD7-C1

Dr. Lawrence G. Roberts
MIT Lincoln Laboratory
Lexington, Massachusetts 02173

Dear Larry:

The purpose of this letter is to discuss the financial aspects of the proposed continuation of the work we started for you under Lincoln Laboratory Purchase Order CC-887. As you recall, this Purchase Order covers the period through 31 December 1965. We are proposing extending this work through 30 June 1966. During this time we would provide approximately 7.5 man-months of effort.

The technical work to be performed in this continuation was discussed in our meeting of 18 November, and is outlined in my memorandum to you dated 24 November 1965.

We propose an extension of our current time-and-materials contract, at the same hourly rates which have already been approved by Lincoln Laboratory. These rates are as follows.

Thomas Marill	\$25.00 per hour
Burton Bloom	16.00
William Mann	12.00
Wesley Clark (Consultant)	\$150 per day

Out-of-pocket expenses such as printing, travel, and long-distance telephone will be charged out at cost, as at present.

The total time charges are estimated at \$24,430. The out-of-pocket charges are estimated at \$2,995, giving a total of \$27,425.

Dr. Lawrence G. Roberts
26 November 1965
Page 2

If I can be of help in any way regarding this matter, please give me a call. As you know, I will be on a trip this coming week, but I will be back at my office on 6 December.

Best regards,

A handwritten signature in dark ink, appearing to read 'Tom' or 'Thomas', with a stylized flourish at the end.

Thomas Marill

TM:mmm